






THE MODES OF ORIGIN OF THE CAROTID AND SUBCLAVIAN ARTERIES FROM THE ARCH OF THE AORTA IN SOME OF THE HIGHER PRIMATES.

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1. *A Tabular Statement.*—Our knowledge of the less common modes in which the carotid and subclavian arteries take their origin from the arch of the aorta, is in Man fairly complete; but in the higher Primates, as may be seen from the accompanying Table, it is comparatively scanty.

						Other varieties.
	A	B	C	D	E	
500 cases, ¹ ...	...	53	...	...	441	6
Man, 187 cases, ² . . .	...	7	...	15	161	4
Gorilla, 9 cases, ³ . . .	...	...	1	...	8	...
Chimpanzee, 11 cases, ...	...	...	3	...	7	1
Orang, 15 cases, . . .	...	1	11	3	...	...
Gibbon, 20 cases, . . .	...	10	7	3	...	...
Semnopithecus cinereus and femoralis, 23 cases,	9	14	...	...	...	...
Macacus namestrinus cynomolgus and aretoides, 22 cases, ...	13	7	2	...	...	...
Mycetes, 3 cases, . . .	...	2	...	...	1	...
Ateles, 3 cases, . . .	3	...	3	...	...	...

2. *The various types form a series.*—The table shows that the prevailing combinations of aortic arch branches, found in this group of animals, constitute a series which may be regarded as progressing from the type A to the type E. In the type A, the four pre-aortic trunks arise from the aortic arch by an almost

¹ "Third Annual Report of the Committee of Collective Investigation of the Anat. Soc.," *Journ. Anat. and Phys.*, 1893, vol. xxvii. p. 191.

² *The Anatomy of the Arteries of the Human Body*, Richard Quain, 1844.

³ The various sources from which these cases were obtained will be found in the reference literature added to this paper. Descriptions of two orangs, ten gibbons, and the cynomorphous monkeys are from dissections made by myself. The four specimens in the Museum of the Royal College of Surgeons, London, of the aortic arches of the gorilla, chimpanzee, orang, and gibbon are also included.

common origin; in type B, the left subclavian has moved its origin some distance from the innominate, and the left carotid has made some approach towards taking its origin directly from the aorta; while the types C, D, and E apparently represent further stages of a migratory tendency in the same direction. This series finds its natural climax when the right carotid also reaches down and takes an independent origin from the aorta. The rare human anomaly of a right external carotid taking a direct origin from the arch also belongs to this series. The anomalous arrangement, found in a chimpanzee by Chapman, where the left carotid arose with the left subclavian from a short left innominate trunk, we may regard as an instance in which the left carotid had not only moved towards but actually fused with the left subclavian. Such an origin for the left carotid will probably be found to occur as a prevailing variation in the chimpanzee, for in another individual of that genus an approximation to this condition was observed.

3. *How the various types may be brought about by modifications of the early fetal representatives of a visceral-arch arterial system.*—In 1862 Sir William Turner¹ accounted for the various forms in which the primary branches of the aortic arch are combined, by the modifications which the precursors of these vessels underwent, during the transmigration of the heart thoracicwards. The explanation then offered still holds good, although the subsequent contributions of Professor His² and Professor Yule Mackay³ have amplified our knowledge of the early foetal arrangement *and relationship* of the pre-cardiac vessels. These vessels—representatives of the visceral-arch system—in the human embryo of the second month, radiate from the dilated extremity of the *truncus arteriosus* pretty much like the fingers of a glove,—the future aorta, of course, being one of the emerging vessels. The dilated extremity of

¹ "On the irregularities of the pulmonary artery, arch of the aorta, and the primary branches of the arch, with an attempt to illustrate their mode of origin by a reference to development," *Brit. and For. Med. and Chirurg. Rev.*, vol. xxx., 1862, pp. 173 and 446.

² *Anatomie Menschlicher Embryonen*, Leipzig, 1880.

³ "The development of the branchial arterial arches in birds, with special reference to the origins of the subclavian and carotid arteries," *Phil. Trans.*, 1888, part 2, vol. 179.

the *truncus arteriosus* may be correctly enough regarded as made up of the fused basal ends of the arteries of the visceral arches, and it is out of this common basal part, during the retrogression of the heart, that the basal parts of the future common carotid and subclavian arteries are carved. The various typical arrangements, in which the primary branches of the arch of the aorta occur in the higher Primates, may be accounted for by the amount of inter-arterial cleavage.

4. *Why the various forms?*—The type prevailing in each genus in all probability best serves the body-economy of that genus, but how it does so is by no means clear. Sir Richard Owen concluded that the origins of the left subclavian and carotid arteries moved distalwards on the aortic arch as the transverse diameter of the chest relatively increased. That this tendency is associated with such an increase is strongly suggested by the arrangement of the primary branches of the aortic arch in such animals as the seal, beaver, manatee, bat, howler, chimpanzee, gorilla, and man; but, if the chest measurements afforded by articulated skeletons are to be relied upon, the differences between the chest diameters of the gibbon and orang on the one hand, and the gorilla and chimpanzee on the other, are insufficient to account for the disparity in the arrangement of the aortic arch trunks in these animals. Touching this matter, it would be well to observe if the cynomorphous arrangement, when it occurs in Man, is accompanied by any approximation to the cynomorphous form of chest. It is doubtful if one can legitimately construe this apparently cynomorphous reversion in the arrangement of the primary branches of the aortic arch in Man as an atavistic tendency: more probably it has no more morphological worth than the degree of interdigital webbing.

5. *Atypical origins of the left vertebral and thyroidea ima arteries.*—Although in about 6 per cent. of men the left vertebral artery has its origin transferred to the arch of the aorta, it was not thus found in even one of the *primate* dissections above enumerated. Herein lies one tendency, in its frequency at least, peculiarly human.

The *thyroidea ima*, however, arose from the aortic arch in one chimpanzee, and from the left carotid artery in one gorilla,

four gibbons, three *semnopithecques*, and two macacques. In some of the two genera last mentioned it arose from the carotid artery in the neck, so that it is hard to distinguish between this form proper and a detached branch of the superior thyroid. In fact, the fork between the carotids, which represents the bifurcation of the primitive ventral aortæ, forms a partial ellipse upon which the origin of this artery may course.

6. *On the study of variations, in general, and the study of the variations in the arrangement of the primary branches of the aortic arch, in particular.*—An extended observation will probably show that nearly-allied races are more emphatically distinguished by the kind and frequency of their anatomical variations than by what would be described as their typical structure. What little we know of the anatomy of the negroid races brings out this fact prominently; for although in typical structure the white and negroid races agree, yet in the character and frequency of their variations from that type, they differ markedly. For instance, the cynomorphous arrangement of the primary branches of the aortic arch occurs as a variety in the negroid races with thrice the frequency found in the white races. At any rate, fifty other points, osteological, cerebral, and myological, could be cited to prove that the example given is not an isolated instance, but part of a general characteristic of the negroid race. While investigating the anatomy of the *Hylobates* recently, the frequency and even character of the variations in structure of the *Siamang* were, I found, strikingly different from those of the other gibbons.

In working out the conditions which accompany and surround human anatomical variations, assistance is likely to be obtained by a much extended investigation into the anatomy of the higher Primates. If the theory of descent be true, we may regard the animals that, structurally, most nearly approximate to Man as control experiments launched by Nature, upon which we may test our speculations as to the causes of human variations. To that end it is necessary to give, with each record published, an exact inventory of the amount of material used. The method of taking an anatomical census of the race has long supplanted the old manner of describing single individuals selected as types, as far as human anatomy is concerned, but the

newer system has yet to be applied to other animals. A type has rightly come to be recognised as a mental realisation, with no bone and flesh embodiment; whereas, by applying the newer anatomical methods, the race becomes, as it were, a great amœboid form, with its preponderating variations thrown out as pseudopodia feeling towards adaptation.

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